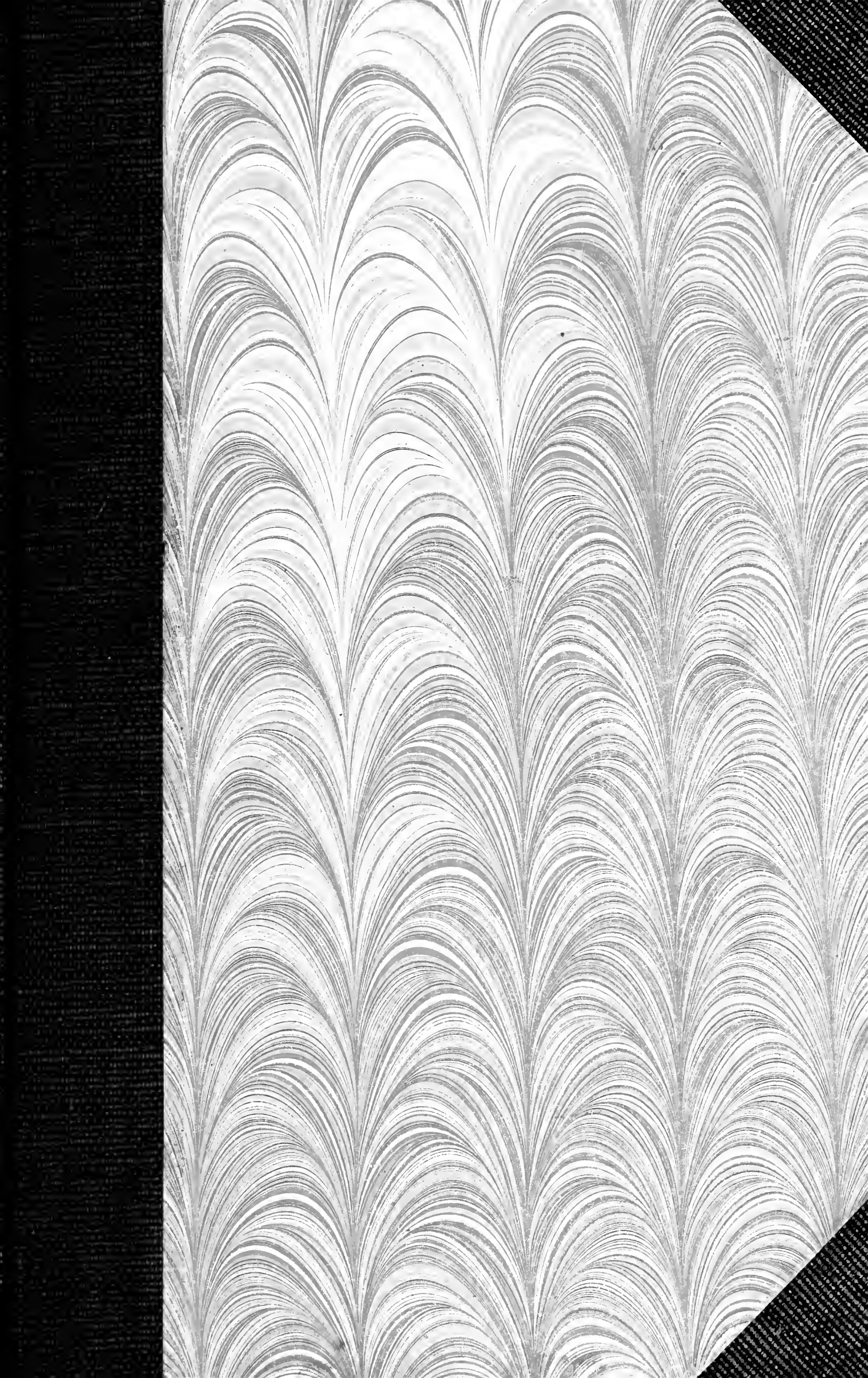

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The Discovery of Radium

It is my earnest desire that some of you shall carry on this scientific work and will keep for your ambition the determination to make a permanent contribution to science

M. Curie

Address by

Madame M. Curie

at Vassar College

May 14, 1921

PREFATORY NOTE

IN HER recent visit to America, Madame Curie conferred a special honor upon Vassar College by delivering in the chapel on the evening of May fourteenth the only extended address which she made in this country. In a simple, straightforward way she told the story of her great achievement. One realized how, closely environed by all the great realities of human experience, in the face of tremendous difficulties and with limited resources, she had pursued undaunted her search for truth.

The discovery of radium gave Madame Curie immediate distinction among scientists on account of the extremely significant contribution she thereby made to the great ultimate problem of physical science, the constitution of matter. The striking properties possessed by radium gave to its discovery a world-wide interest, all the more intense because of the hope which was inspired by the possible healing qualities of the radiations from this new element.

That hope is being realized in large measure. It is therefore fitting that this address should have been given by Madame Curie at Vassar and that it should now be circulated among the members of the college under the foundation in memory of Ellen S. Richards, who devoted her life to the public health.

Edna Carter

Chairman of the
Department of Physics.

THE DISCOVERY OF RADIUM

I could tell you many things about radium and radioactivity and it would take a long time. But as we can not do that, I shall only give you a short account of my early work about radium. Radium is no more a baby, it is more than twenty years old, but the conditions of the discovery were somewhat peculiar, and so it is always of interest to remember them and to explain them.

We must go back to the year 1897. Professor Curie and I worked at that time in the laboratory of the school of Physics and Chemistry where Professor Curie held his lectures. I was engaged in some work on uranium rays which had been discovered two years before by Professor Becquerel. I shall tell you how these uranium rays may be detected. If you take a photographic plate and wrap it in black paper and then on this plate, protected from ordinary light, put some uranium salt and leave it a day, and the next day the plate is developed, you notice on the plate a black spot at the place where the uranium salt was. This spot has been made by special rays which are given out by the uranium and are able to make an impression on the plate in the same way as ordinary light. You can also test those rays in another way, by placing them on an electroscope. You know what an electroscope is. If you charge it, you can keep it charged several hours and more, unless uranium salts are placed near to it. But if this is the case the electroscope loses its charge and the gold or aluminum leaf falls gradually in a progressive way. The speed with which the leaf moves may be used as a measure of the intensity of the rays; the greater the speed, the greater the intensity.

I spent some time in studying the way of making good measurements of the uranium rays, and then I wanted to know if there were other elements, giving out rays of the same kind. So I took up a work about all known elements, and their compounds and found that uranium compounds are active and also

all thorium compounds, but other elements were not found active, nor were their compounds. As for the uranium and thorium compounds, I found that they were active in proportion to their uranium or thorium content. The more uranium or thorium, the greater the activity, the activity being an atomic property of the elements, uranium and thorium.

Then I took up measurements of minerals and I found that several of those which contain uranium or thorium or both were active. But then the activity was not what I could expect, it was greater than for uranium or thorium compounds like the oxides which are almost entirely composed of these elements. Then I thought that there should be in the minerals some unknown element having a much greater radioactivity than uranium or thorium. And I wanted to find and to separate that element, and I settled to that work with Professor Curie. We thought it would be done in several weeks or months, but it was not so. It took many years of hard work to finish that task. There was not one new element, there were several of them. But the most important is radium which could be separated in a pure state.

All the tests for the separation were done by the method of electrical measurements with some kind of electroscope. We just had to make chemical separations and to examine all products obtained with respect to their activity. The product which retained the radioactivity was considered as that one which had kept the new element; and, as the radioactivity was more strong in some products, we knew that we had succeeded in concentrating the new element. The radioactivity was used in the same way as a spectroscopical test.

The difficulty was that there is not much radium in a mineral; this we did not know at the beginning. But we now know that there is not even one part of radium in a million parts of good ore. And too, to get a small quantity of pure radium salt, one is obliged to work up a huge quantity of ore. And that was very hard in a laboratory.

We had not even a good laboratory at that time. We worked in a hangar where there were no improvements, no good chemical arrangements. We had no help, no money. And because of that the work could not go on as it would have done under better conditions. I did myself the numerous crystalizations which were wanted to get the radium salt separated from the barium salt with which it is obtained out of the ore. And in 1902 I finally succeeded in getting pure radium chloride and determining the atomic weight of the new element radium, which is 226 while that of barium is only 137.

Later I could also separate the metal radium, but that was a very difficult work; and, as it is not necessary for the use of radium to have it in this state, it is not generally prepared that way.

Now, the special interest of radium is in the intensity of its rays which is several million times greater than the uranium rays. And the effects of the rays make the radium so important. If we take a practical point of view, then the most important property of the rays is the production of physiological effects on the cells of the human organism. These effects may be used for the cure of several diseases. Good results have been obtained in many cases. What is considered particularly important is the treatment of cancer. The medical utilization of radium makes it necessary to get that element in sufficient quantities. And so a factory of radium was started to begin with in France, and later in America where a big quantity of ore named carnotite is available. America does produce many grams of radium every year but the price is still very high because the quantity of radium contained in the ore is so small. The radium is more than a hundred thousand times dearer than gold.

But we must not forget that when radium was discovered no one knew that it would prove useful in hospitals. The work was one of pure science. And this is a proof that scientific

work must not be considered from the point of view of the direct usefulness of it. It must be done for itself, for the beauty of science, and then there is always the chance that a scientific discovery may become like the radium a benefit for humanity.

But science is not rich, it does not dispose of important means, it does not generally meet recognition before the material usefulness of it has been proved. The factories produce many grams of radium every year, but the laboratories have very small quantities. It is the same for my laboratory and I am very grateful to the American women who wish me to have more of radium and give me the opportunity of doing more work with it.

The scientific history of radium is beautiful. The properties of the rays have been studied very closely. We know that particles are expelled from radium with a very great velocity near to that of the light. We know that the atoms of radium are destroyed by expulsion of these particles, some of which are atoms of helium. And in that way it has been proved that the radioactive elements are constantly disintegrating and that they produce at the end ordinary elements, principally helium and lead. That is, as you see, a theory of transformation of atoms which are not stable, as was believed before, but may undergo spontaneous changes.

Radium is not alone in having these properties. Many having other radioelements are known already, the polonium, the mesothorium, the radiothorium, the actinium. We know also radioactive gases, named emanations. There is a great variety of substances and effects in radioactivity. There is always a vast field left to experimentation and I hope that we may have some beautiful progress in the following years. It is my earnest desire that some of you should carry on this scientific work and keep for your ambition the determination to make a permanent contribution to science.

M. Curie.

With my friendship
for the students of Vassar College —
M. Curie